IPM PACKAGE NO. 75

INTEGRATED PEST MANAGEMENT PACKAGE

FOR

KIWI

Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation
Directorate of Plant Protection, Quarantine & Storage
N. H. IV, Faridabad - 121 001.

IPM PACKAGE FOR KIWI

CONTENTS

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FOREWARD

Integrated Pest Management (IPM) approach has been globally accepted for achieving sustainability in agriculture. It has become more relevant due to a number of advantages like safety to environment, pesticide-free food commodities, low input cost based Crop Production Programme etc. Though IPM approach has been taken up since 1981, its impact has not been felt until 1994. Human Resource Development has helped to sensitise extension functionaries and farmers about the usefulness of IPM.

For successful implementation of IPM, the scattered information on various components of this eco-friendly approach forms basic necessity. In this direction, initial attempts were made in 1992 to harmonise the IPM Package of Practices of various crops. Subsequently, concerted efforts were made in 1998, 2001, 2002 and 2003 to update and develop IPM Package of Practices for agricultural and horticultural crops. Presently, IPM Package of Practices for 77 crops have been finalized to help the extension workers and farmers to manage the pests and diseases and to minimize the over use/misuse of chemical pesticides. Efforts have been made to incorporate the relevant available technical input provided by the scientists of ICAR Institutes/ SAUs and State Departments of Agriculture/Horticulture. However, suggestions for further improvement in future publication/ revision will be of immense help. Hopefully, these IPM Package of Practices will be useful for the Researchers, Plant Protection Workers and Farmers alike.

Chandurkar.
14/8/03
(P. S. CHANDURKAR)

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PREFACE

In order to minimize the indiscriminate and injudicious use of chemical pesticides, INTEGRATED PEST MANAGEMENT (IPM) has been enshrined as cardinal principle of Plant Protection in the overall Crop Protection Programme under the National Agricultural Policy of the Govt. of India. IPM is an eco-friendly approach for managing pest and disease problems encompassing available methods and techniques of pest control such as cultural, mechanical, biological and chemical in a compatible and scientific manner. The greater emphasis has been given on biological control including use of biopesticides.

With a view to provide technical knowledge to the extension functionaries and farmers in the States, first National Workshop on IPM for harmonization of Package of Practices was organized at National Plant Protection Training Institute (NPPTI), Hyderabad during June 29-30, 1992. Subsequently workshops were organized on April 15-17, 1998 and Nov. 5-6, 1998 at the Directorate of Plant Protection, Quarantine & Storage, Faridabad and IPM Package of Practices for 20 crops were finalized on rice, cotton, vegetables, pulses and oilseeds. In this series, two National Workshops on IPM have been conducted at NPPTI, Hyderabad and Dte. of PPQ&S, Faridabad during 14-17, 2001 and Feb. 20-22, 2002 respectively to update 20 available IPM Packages and develop 31 new IPM Packages especially for horticultural crops. Sixth and Seventh National Workshop held at Central Insecticides Laboratory, Faridabad on 4th-5th July, 2002 and 9th-10th January, 2003 respectively for 18 IPM Packages and Eighth National Workshop was held at NPPTI, Hyderabad on 28th–29th May, 2003 for 8 IPM Packages. In these Workshops, 77 IPM Package of Practices for cereal crops (Rice, Wheat, Maize, Sorghum, Millets), commercial crops (Cotton, Sugarcane, Tobacco, Tea, Betelvine, Saffron), pulse crops (Pigeonpea, Gram, Black gram/Green gram, Pea, Rajma), oilseeds (Groundnut, Soybean, Rapeseed/Mustard, Sesame, Olive, Safflower, Castor, Sunflower, Oilpalm), vegetables (Potato, Onion, Tomato, Brinjal, Okra, Chillies, Cruciferous vegetables, Leguminous vegetables, Cucurbitacious vegetables, Broccoli, Spinach, Lablab bean, Garlic), fruits (Citrus, Banana, Apple, Mango, Guava, Grapes, Jackfruit, Pineapple, Sapota, Pomegranate, Litchi, Papaya, Apricot, Peach, Pear, Cherry, Walnut, Ber, Amla, Loquat, Strawberry, Watermelon, Fig, Phalsa, Persimmon, Custard apple, Raspberry, Kiwi, Passion fruit), spice and plantation crops (Small Cardamom, Large Cardamom, Black Pepper, Ginger, Coriander, Cumin, Fennel, Coconut, Cashew and Arecanut) have been finalized.

IPM technology manages the pest population in such a manner that economic loss is avoided and adverse side effects of chemical pesticides are minimized. The IPM packages encompass various management strategies for containing the pest and disease problems. Pest monitoring is one of the important components of IPM to take proper decision to manage any pest problem. It can be done through Agro-Ecosystem Analysis (AESA), field scouting, light, pheromone, sticky/yellow pan traps. The economic threshold levels (ETL) of important pests and diseases are also given in the packages to take appropriate control measures when pest population crosses ETL.

These IPM packages developed with the technical inputs from experts from Indian Council of Agricultural Research, State Agricultural Universities, Central Directorate of Plant Protection, Pesticide Industries and State Departments of Agriculture/Horticulture will provide technical backup in the management of pests, diseases, weeds, nematodes and rodents in the agriculture and horticulture. These will also be useful in reducing the pesticide residues in agricultural commodities and would also help in the management of pests/diseases/weeds/nematodes which may get inadvertently introduced in the country.

IPM Package of Practices for agricultural and horticultural crops will be helpful to minimize the ill-effects of chemical pesticides to promote the IPM for sustainable production. These IPM packages will be useful for the researchers, extension workers and farmers alike who are engaged in the agricultural practices.

7th October, 2003

(A. D. Pawar)
Addl. PPA-cum-Director(IPM)

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		7.	Sh. N. K. Mishra, LDC, Dte. of PPQ&S, Faridabad.

IPM PACKAGE FOR KIWI

I. MAJOR PESTS:

A. INSECT PESTS

1. Leaf Rollers
   a. Brown headed leaf roller *(Ctenopseustis obliquana)*
   b. Green headed leaf roller *(Planotortrix notophaeana)*
2. Greedy Scale *(Hemiberlasia rapax)*
3. Passionvine hopper *(Scolypopa australis)*
4. Two spotted mite *(Tetranychus utricae)*
5. Thrips *(Heliothrips spp.)*

B. DISEASES:

1. Root rot, collar rot and crown rot *(Phytophthora spp.)*
2. Leaf spots *(Altemaria* spp., *Colletotrichum, Fusarium,Penicillim* and *Phoma* etc.*)*
3. Sclerotinia rot *(Sclerotinia sclerotiorum)*
4. Storage rot *(Botrytis cinerea)*
5. Bacterial leaf spot and blossom blight *(Pseudomonas virdiflava)*
6. Stem rot *(Rhizoctonia solani)*

C. NEMATODES:

1. Root Knot nematode *(Meloidogyne incognita)*

D. WEEDS:

1. Dub Grass *(Cynodon dactylon)*
2. Bathua *(Chinopodium spp.)*
3. Motha *(Cyprus rotundus)*

E. RODENTS:

1. Indian mole rat *(Bandicota bengalensis)*
2. Soft furred field rat *(Melardia meltada)*
3. Field mouse *(Mus beoduga)*

II. PEST MONITORING

A. SURVEY :

The objective of survey through roving surveys is to monitor the initial development of pest and disease in the endemic areas. Therefore, for field scouting farmers should be mobilized to observe the pest and disease occurrence at the intervals as stipulated under different developmental stages. The plant protection measures are required to be taken only when biocontrol potential does not show promise and pest and diseases incidences shows increasing trend.

B. FIELD SCOUTING :

Field scouting for pests / diseases and biocontrol fauna/ flora by extension agencies and farmers once in a fortnight should be undertaken to assess increasing/ decreasing trend in the pest / disease incidence and availability of biocontrol pontential. This should be done soon after the appearance of new flush after the fall of old leaves as such stage of the crop having succulent tissues is vulnurable to attack by pests and diseases. The State Department of Horticulture should make all possible efforts by using diferent media, mode and publicity to inform the farmers for field scouting in the specific crop area having indication of pest and disease build up.

C. PEST MONITORING THROUGH TRAPS :

1. **Through yellow sticky traps :** Setup yellow fast coloured sticky traps for monitoring sucking pests (one trap / 5 trees). Locally available empty yellow palmolive - tins coated with grease / vaseline/ castor oil on outer surface may also be used.

2. **Through pheromone traps :** Certain pests of fruit crops require installation of pheromone traps to monitor initial pest build up and suppression of its increasing population. Sticky pheromone traps may also be used @ 5-7 traps per ha. are sufficient for effective monitoring.

III. IPM STRATEGIES

A. CULTURAL PRACTICES

1. Plant material for laying quality fruits should be obtained from registered nursery and should be free from any pest infestation.
2. Plants should be spaced 3 X 3 meters apart and pruned hard to encourage vigorous growth.
3. Plants should be trained with the help of supporting wire to form a roof like structure to protect fruits from sun-burn and bird damage.
4. In summer, keep the vines open and avoid crowding and excessive shading of wood.
5. Repeatedly ploughing around the plant to expose the soil pests to unfavorable environment conditions and predation by natural enemies.
6. Remove and destroy all infested leaves, twigs and fruits to prevent further spread of pests.
7. Avoid water logging and keep the soil aerated.
8. Locate the affected plants in early stages by examining the roots and root collar regions showing weakening signs. Dig out decayed roots and cut them completely right from the collar region and treat the cut ends with Bordeaux Mixture paste.
9. Proper pruning be done during dormant season to maintain fruiting arms.
10. Mulching with dry grass (10 cm thick) should be done during summer.

B. MECHANICAL PRACTICES

1. The sucking pests affected leaves and twigs should be cut and destroyed.
2. Cut the dried branches, 10 cm below from the dried portion and apply paste of copper oxychloride for the control of die back disease.
3. Collection and destruction of egg masses, larvae and pupae of insects be done wherever possible.
4. Infested plants should be uprooted and destroyed completely especially rootzone.

C. BIOLOGICAL PRACTICES

1. Number of effective parasitoids, predators, and pathogens are very active against pests of Kiwi fruit viz, spiders, *Coccinellids, Chrysoperla spp., Trichogramma spp*,. and *Phytoseiulus persimilis* which could be conserved by using various conservation methods.

2. Before raising plant nursery make use of *Trichoderma* spp. with FYM in ration of 1:40 to control the root rot, collar rot and crown rot diseases.

3. Spray *Bacillus thuringiensis var Kursaki* @ 0.5 kg per ha. against lepidopteran pests.

4. Grow flowering plants especially marigold on the peripheries and legumes as inter crops for conservation of natural enemies and increasing soil fertility.

5. Monitor the incidence of sucking pests and make release of predators e.g. lady bird beetles @ 30-50 adults per infested plant, green lace wings *(Chrysoperla spp.)* and *Syrphid spp.* @ 10-20 first instar larvae per plant; parasitoids e.g. *Trichogramma spp.* @ 10000-20000 per infested plant may be released for control of lepidopteran pests.

6. Make use of solar energy for soil sterilization for nursery beds.

7. Install pheromone traps for monitoring and destroy the entrapped insects for population suppression.

D. CHEMICAL PRACTICES

Need based, judicious and safe application of pesticides are the most vital, tripartite segments of chemical control measures under the ambit of IPM. It involves developing IPM skills to play safe with environment by proper crop health monitoring. Observe ETL and pest defender ratio before deciding in favour of use of chemical pesticides.

1. Oil spray during dormant season be made for greedy scale control @ 2-3 litre per 100 litre of water.

2. Two sprays of 0.05% Chlorfenvinphos or Quinalphos at 7 days interval were found quite effective to check scale insects during growing season.

4. Leaf rollers can be controlled by spraying 0.05% Dichlorvas or Fenitrothion.

5. To control root rot , collar rot and crown rot, spray Bordeaux mixture or 0.03% Copper oxychioride.

6. Application of NSKE (Neem Seed Kernel Extract) @ 5% helps in reducing the population of various insect pests.

7. For control of mites, spray dicofol 0.05% and wettable sulphur (0.25%) when mite population exceeds 20 per leaf.

8. For control of leaf spots and dieback diseases, spray the solution of copper oxychloride or captan or mancozeb (250-300 g/litre water) at 15 days interval if necessary.

9. For control of bacterial leaf spot and blossom blight spray the solution of streptocycline (10gm /100 litre water).

10. For control of ripe and storage rot, spray the solution of captan 75 wp or mancozeb (250-300g) / 100 litre water) or carbendazim (50g/litre water).

11. For rodent control, pre- baiting with plain food material is necessary before placing zinc phosphide or bromadiolone poison baits in rodents burrows.

12. Fumigate live burrows with aluminium phosphide tablets (1 tablet/burrow) and close the burrows.If soil is dry, pour 1-2 litre water per burrow.

13. For control of nematodes application of carbofuran @ 4kg a.i. per ha or neem cake @ 3kg / plant was found promising.

IV. DO'S AND DON'TS

DO's	DON'TS
1. Grow only recommended cultivars.	Do not grow under script material which vary greatly in fruiting pattern and pest susceptibility.
2. Consider soil profile and texture before establishing an orchard.	Don't establish an orchard in the soils not suited for its cultivation.
3. Solarisation of nurseries be adopted before raising plant surseries.	Do not raise plant nursuries without soil sterilization.
4. To check the infection of soil borne fungus in the nursery, make use of antagonistic fungus i.e. *Trichoderma viride* and *T. harzianum*. Neem cakes can also be used to ward off any soil pest.	Don't raise the nurseries in low lying areas, especially where no drainage can be made. Surface water must be drained off wherever possible.
5. Both stock and cuttings must be healthy and preferably of known pedigree.	Do not use the material from unknown pedigree.
6. Nursery area for producing quality fruit should have proper irrigation and drainage system.	Plants should not neither be forced to drought nor to water lodged conditions.
7. Plant material for laying an orchard should be obtained from registered nurseries only.	Don't take the planting materials from unregistered nurseries.
8. For producing quality fruits, the plants should be pruned properly to have a well balanced frame work and fruiting arms.	In bearing plants heavy pruning should be avoided.
9. Trees should be supplied with FYM and all the major and micro nutrients on the basis of soil and leaf analysis.	Don't over dose the plants with any of the fertilizers.
10. The ratio of male & female plants should be kept 1:6 in the orchard.	Do not raise the orchards with equal number of male & female plants.
11. Leguminous cover crops be grown in orchards to improve soil fertility, to prevent soil erosion and controlling of weeds.	Do not allow unwanted plants to grow in orchards.

12. Fertilizers should be applied 30.0 cms. away from the trunk in old plants.	Do not apply the fertilizers close to the trunks especially in old plants.
13. In rich soils, the fertilizer doses may be halved or regulated on the basis of leaf analysis report.	Don't make use of raw cow dung or raw FYM which increases pest incidence.
14. 3-4 bee hives should be provided per ha. for better pollination.	Don't make pesticide sprays during flowering period as it kills the pollinators.
15. Water shoots, diseased, insects infested and intermingling branches should be removed as early as possible.	Don't allow the water shoots, diseased and insect infested plant material to remain in the orchards.
16. Pruning should be done close to the branches leaving no stubs.	Don't leave prunned portions unpainted.
17. Ensure the destruction of heavily infested plants / dead and drying fruit plants to ward off pest infestation.	Do not leave dead or pruned wood laying in an orchard.
18. Destroy the pest infested seedlings.	Do not plant pest infested seedlings.
19. Complete collection and destruction of foliage during fall by decomposition be made.	Do not burn collected foilage to avoid air pollution.
20. Conduct sprays during morning and evening hours only.	Do not spray during hot period of the day.
21. Cankered portions must be cleared with sharp knife and should be covered with Bordeaux paint.	
22. Make use of stickers (adjuvants) for better efficiency of fungicides.	
23. Ensure regular monitoring for timely detection of ETL's required for need based application of chemical sprays.	Don't go for blanket spray without field roving.

24. Use recommended pesticides and spray technology only as per need.

Don't use of unrecommended mixtures of various insecticides in any case.

25. Encourage the cultivation of flowering plants and maize on the peripheries for the conservation of both predators and parasitoids

26. Fruits should be harvested when these are still hard.

Don't allow the fruits to ripe while on the vine.

27. Polythene packing should be done when fruits are to be kept in refrigeration.

Avoid fruits refrigeration without polythene packing.

Annexure-I

AGRO ECO SYSTEM ANALYSIS (AESA)

A. FIELD OBSERVATIONS :

a) Enter the orchard at least 15-20 feet away from road/ bund. Select a plant of medium size randomly.

b) Record the visual observations on the following parameters :

i) Flying insects (both pests and defenders).

ii) Close observation on pest and defenders which remain on the plant.

iii) Observe pests like scale, thrips, caterpillars and defenders like lady bird beetles, green lace wings, anthocorids, bugs, spiders, predatory ants and mites.

iv) Record various diseases and their intensities.

v) Record insect damage in percentage or otherwise in case of non uniform pests like scale.

c) Record parameters like number of pest per leaf randomly around the plant canopy on the periphery at chest and head height. This concept is needed to establish the initial life stages and distribution of pest. Regular counts of pest and its enemy population on a 7-10 day interval are needed. The pest population is sampled by determining the number of pests on at least 10 leaves collected around the plant and from five or more plants per monitored orchard. The number of plants selected to sample would depend largely on the size of the orchard. The plants selected for samplings should be representatives of the entire orchard in size and cultivar. Preferably cultivars which are sensitive to pest attack should be taken for sampling. The bioagent population is surveyed on the same plant as the pest and is accomplished by slowly walking around the periphery of the plant recording the number of adults and larvae visually. The bioagent survey should be done before leaves are collected for sampling the pest population or the number of main limbs infested with scale.

d) Record soil conditions viz. dry, wet or water lodged.

e) Observe rodent live burrows.

f) Repeat the steps from (b) to (e) on at least 5 plants in a diagonal row or cris-cross fashion across the orchard to have overall average assessment of the orchard.

g) Record the climatic factors like sunny, partially sunny, cloudy, rainy etc. for the preceding week.

B. DRAWING :

First draw the plant with actual number of main limbs in the centre of a chart. Then draw pest on left side and defender on the right side. Indicate the soil condition, rodent damage, etc. Give natural colours to all the drawings, for instance draw healthy plant with green colour, diseased plant / leaves with yellow colour. While drawing the pests and the defenders on the chart care should be taken to draw them at appropriate part of the plant, where they are seen at the time of observation. The common names of the pests and defenders and their population count should also be given alongwith diagram. The weather factor should be reflected in the chart by drawing the diagram of sun just above the plant, if it is sunny. If cloudy, the clouds may be drawn in place of sun. In the case of partially sunny, the diagram of sun may be half masked with clouds.

C. GROUP DISCUSSION AND DECISION MAKING :

The observations recorded in the previous and current charts should be discussed among the farmers and apprentice trainees by raising questions relating to change in pest and defender population in relation to crop stages, soil conditions, weather factors, such as rainy, cloudy or sunny etc. The group may evolve a strategy based upon weekly AESA, ETL and corresponding change in P : D ratio and take judicious decision for specific pest management practices.

D. STRATEGY FOR DECISION MAKING (Example) :

i) When weather is hot and dry without any rain, group may suggest for no spray otherwise recommended against fungal diseases. Similarly they can suggest monitoring and surveillance only for build up of disease till ETL is crossed.

ii) In case of aphid or thrips if 2-3 larvae of *Chrysopa* spp. or of *Syrphid* fly are present on infested twig or 50% aphids are mummified then there is no need of chemical spray.

iii) In case of scale if 50% of scales are parasitised by its parasitoids or 2-3 lady bird beetles are present per infested twig then there is no need of chemical spray.

iv) When more than 20% foliage of plants are affected by any disease and weather is humid, group may advocate for fungicide spray.

AESA BY EXTENSION FUNCTIONARIES :

The extension functionaries during their regular visit to the village should mobilise the farmers, conduct AESA and critically analyse the various factors such as the pest population viz-a-viz defender population and their role in natural suppression of the pest, the influence of prevailing weather and soil conditions on the likely build up of pest & defender population. They may also take the decision based on the AESA, with IPM components like release of defenders, application of neem formulations / safe pesticides on any specific pest situation. Such an exercise may be repeated by the extension functionaries during every visit to the village and motivate the farmers to adopt AESA in their fields.

AESA BY FARMERS :

After a brief exposure during IPM demonstrations/ field trainings, farmers can practise AESA in their own fields. Wherever trained farmers are available their experiences could be utilised in training their fellow farmers in their own villages. Thus, a large group of farmers could be made efficiently competent in undertaking weekly AESA thereby empowering themselves in decision making on any specific pest situations. Farmers - to farmers training approach will go a long way in practicing IPM on a large area on sustainable basis.

Annexure-II

BASIC PRECAUTIONS IN PESTICIDE USAGES

A. Purchase

1. Purchase only JUST required quantity e.g. 100, 250, 500 or 1000 gm/ ml for single application in specified area.
2. Do not purchase leaking containers, loose, unsealed or torn bags.
3. Do not purchase pesticides without proper / approved LABELS.

B. Storage

1. Avoid storage of pesticides in the house premises.
2. Keep only in original container with intact seal.
3. Do not transfer pesticides to other container.
4. Never keep them together with food or feed / fodder.
5. Keep away from the reach of children and livestock.
6. Do not expose to Sun-light or rain water.
7. Do not store weedicides along with other pesticides.

C. Handling

1. Never carry / transport pesticides along with food materials.
2. Avoid carrying bulk pesticides (dusts / granules) on head, shoulders or on the back.

D. Precautions for Preparing Spray Solution

1. Use clean water.
2. Always protect your NOSE, EYES, MOUTH, EARS and HANDS.
3. Use hand gloves, face mask and cover head with cap.
4. Use polythene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head (Do not use polythene bag contaminated with pesticides).
5. Read the label on the container before preparing spray solution.
6. Prepare spray solution as per requirement.

7. Do not mix granules with water.
8. Concentrated pesticides must not fall on hands etc., while opening sealed containers. Do not smell the sprayer tank.
9. Avoid spilling of pesticide solution while filling the sprayer tank.
10. Do not eat, drink, smoke or chew while preparing solution.

E. Equipment

1. Select right kind of equipment
2. Do not use leaky, defective equipment
3. Select right kind of nozzle.
4. Don't blow / clean clogged-nozzle with mouth. Use old toothbrushes tied with the sprayer and clean with water.
5. Do not use same sprayer for weedicide and insecticide.

F. Precautions for applying pesticides

1. Apply only at recommended does and dilution.
2. Do not apply on hot sunny day or strong windy condition.
3. Do not apply just before the rains and also after the rains.
4. Do not apply against the wind direction.
5. Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
6. Wash the sprayer and bucket etc. with soap water after spraying.
7. Containers, buckets etc., used for mixing pesticides should not be used for domestic purposes.
8. Avoid entry of animals and workers in the fields immediately after the spraying.

G. Disposal

1. Left over spray solution should not be drained in ponds or water lines etc. Throw it in barren isolated area, if possible.
2. The used / empty containers should be crushed with a stone / stick and buried deep into soil away from water source.
3. Never re-use empty pesticide container for any purpose.